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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 09/934,320
Filing Date: August 21, 2001
Appellant(s): CALVERT ET AL.

Brent R. Knight
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 30th June 2006 appealing from the Office action mailed 28th November 2005.

EXAMINER'S ANSWER

(1) Real Party of Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is incorrect.

The amendment after final rejection filed on 1st February 2006 has been entered. This amendment basically presented arguments and an affidavit under Rule 1.132.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

No evidence is relied upon by the examiner in the rejection of the claims under appeal.

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

1. **Claims 1-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,049,759 issued to John T. Etgen (Etgen '759 hereafter), in view of U.S. Patent No. 4,679,174 issued to Valery A. Gelfand (Gelfand '174 hereafter).**

Regarding Claim 1

(Specific Mapping Added to address appellants remarks in Appeal Brief)

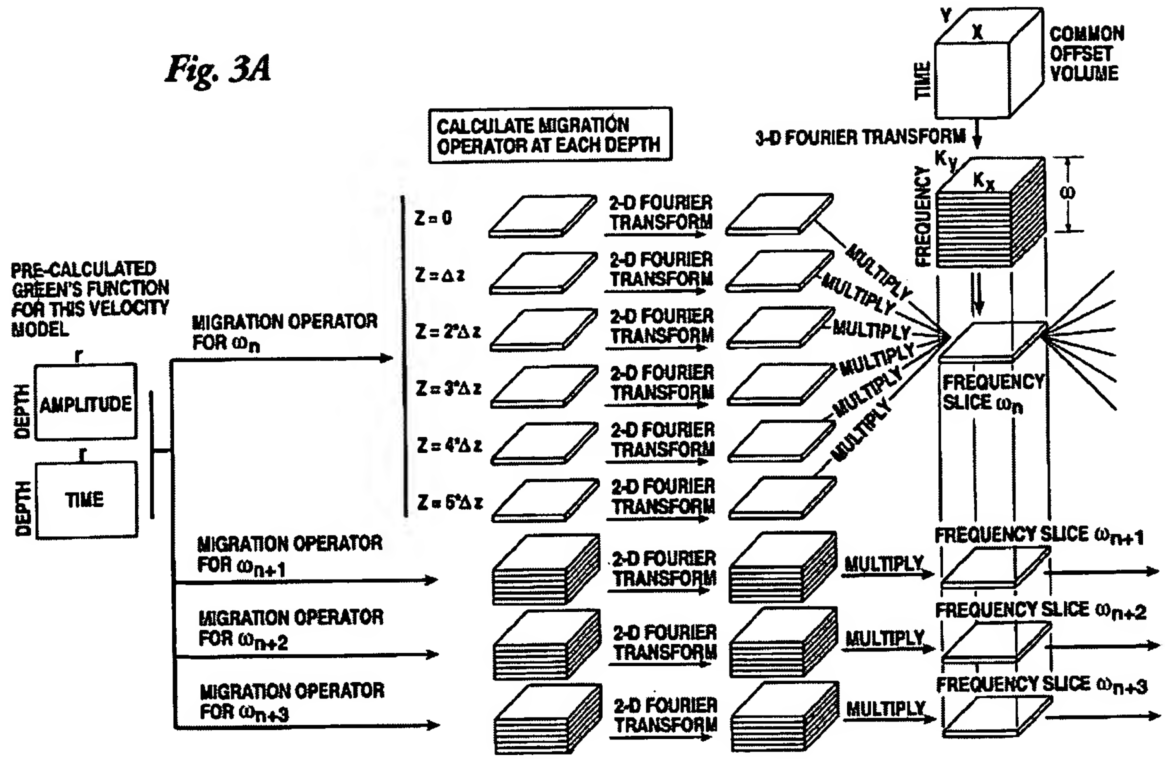
Etgen '759 teaches

> "A method for constructing a three-dimensional geologic model of a subsurface earth volume according to specific geological criteria, comprising the steps of:
>
> (a) generating an initial frequency-pass band model of the subsurface earth volume for at least one frequency pass band;"

as creating a 3-D model for the subsurface geological feature (Etgen '759: Col.15 Lines 15-22) according to specified geological criteria (Etgen '759: Col.17, Lines 38-41, 48-63). Further, Etgen '759 teaches generating an initial frequency-pass band model for one frequency of the subsurface earth volume (Etgen '759: Col.6 Lines 22-26; Col.7 Lines 5-30).

(The step of generating an initial frequency-pass band model of the subsurface earth volume for at least one frequency pass band is taught by Etgen '759 in Fig.3A as at least one frequency slice, whereas multiple slices are disclosed. Appellant's claim do not preclude the use of velocity model in the construction of the frequency model and the appellant's specification makes it clear that data created by different methods is combined [0028]).

Fig. 3A



Further, Etgen '759 teaches

"(b) assigning values for at least one rock property in each initial frequency-passband model;"

as assigning a velocity model consisting of horizontally layered constant velocity media within area of interest (Etgen '759: Col.5 Lines 41-47; Col.17, Lines 38-41, 48-63) to the single frequency model (Etgen '759: Col.6 Lines 1-3, 22-26). Further, Etgen '759 teaches that other sources like well data can be combined to enhance the single frequency model (Etgen '759: col.16 Lines 61-67).

(The step of assigning values for at least one rock property in each initial frequency-passband model is taught by Etgen '759 as assigning rock properties in the velocity model (Etgen '759: Col.17 Lines 48-63, which has multiple frequency passband models (Etgen '759: Fig.3A). The ordering of this step is not relevant as frequency

slice (passbands) already have rock properties assigned to them. Since the method employed by Etgen is uniform for each slice, the assignment of rock properties in the velocity model does not affect the outcome of the modeling. In other words, since Etgen uses the same method, the order of operation does not affect the outcome.)

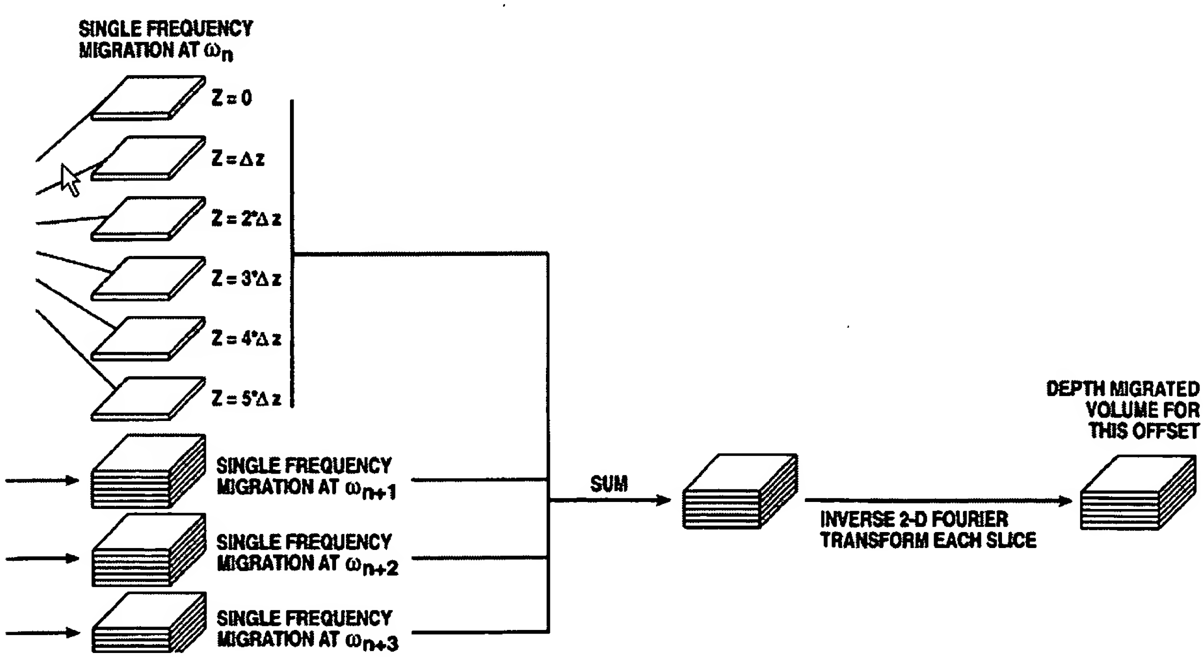
Further, Etgen '759 teaches

> "(c) combining the initial frequency-passband models to form an initial complete three-dimensional geologic model of the subsurface earth volume; and"

as summing up all the individual frequency models to create a complete three-dimensional geological model (Etgen '759: Col.7 Lines 33-35).

(*The step of combining the initial frequency-passband models (Etgen '759: Fig.3A-B – combining the frequencies) to form an initial complete three-dimensional geologic model of the subsurface earth volume (Etgen '759: also Col.24 Lines 25-33)).*

Fig. 3B



Etgen '759 does not teach

> "(d) optimizing the initial complete three-dimensional geologic model by perturbing the rock property values in at least one of the models according to specified geological criteria."

Gelfand '174 teaches optimizing the initial model by the process of perturbing the rock properties (Gelfand '174: Abstract).

It would have been obvious to one (e.g. a designer) of ordinary skill in the art at the time the invention was made to take the teachings of Gelfand '174 and apply them to Etgen '759 to create a 3D geological model from various frequencies and perturb the rock data to achieve the desired degree of correspondence with real data. Although Gelfand '174 is teaching a 2-D Model geological model, the motivation to combine would be that Gelfand '174 teaches the process of geological modeling using the process of perturbing, which can change the underlying geological model to achieve the desired result in iterative steps (Gelfand '174: Abstract). Etgen '759 teaches performing 3-D seismic analysis and model but processes the information much more efficiently (converting the data to frequency domain using Fourier transform) as the data collected is much more (Etgen '759: Col.1 Lines 40-45). Combing the two reference will yield more accurate picture 3-D geological model (Etgen '759: Col.3 Lines 14-20) and perturbation will make the model more precise, a more actual representation of the subsurface conditions (Gelfand '174: Abstract; Col.4 Lines 15-20).

Regarding Claim 2

Gelfand '174 teaches that the tentative passband model can be made out of all the frequencies of 0-200 Hz (Gelfand '174: Col.3 Lines 44-55). This spectrum includes the low (0-20Hz), medium (20-56 Hz) and high band (56 Hz >) as defined by the specification (Specification: Pg.9 [0022]).

Regarding Claim 3

Etgen '759 teaches that seismic frequency passband is represented by the mid-frequency passband (Etgen '759: Col 25 Lines 17-26).

Regarding Claim 4

Gelfand '174 teaches that existing geologic model is full frequency passband (Gelfand '174: Col.2, Lines 49-56).

Regarding Claim 5

Gelfand '174 teaches that initial model is made based on the limits defined in the region and stratigraphics (Gelfand '174: Col.4 Lines 25-36). Etgen '759 teaches 3-D array (matrix) of contiguous model blocks representing the portions of subsurface earth volume (Etgen '759: Col.6 Lines 22-26; Figure 8A).

Regarding Claim 6

Claim 6 is rejected for the same reasons as claim 5 as specification discloses blocks and points to the analogous (Specification: Pg.1 [0002]) and is not enabled to provide the distinction between the claimed blocks and points.

Regarding Claim 7

Etgen '759 teaches that rock properties are measurable properties consisting of P velocity, S velocity, attenuation/dissipation (Q), density, porosity, and permeability (Etgen '759: Col.17 Lines 58-63)(Gelfand '174: Col.2 Lines 1-3). (*Since the limitations are written as a Markush Group, only one limitation (porosity) need be shown to reject claim 7.)*

Regarding Claim 8

Gelfand '174 teaches that pluralities of rock properties are associated to the acoustic propagation velocity (Gelfand '174: Col.1, Lines 50-57, 65-68; Col.2 Lines 1-3). Etgen '759 teaches that velocity models are assigned to frequency models (Etgen '759: col.6 Lines 1-8).

Regarding Claim 9

Gelfand '174 teaches that rock properties assigned to the model can be verified with the real well data (Gelfand '174: Col.2 Lines 4-12).

Regarding Claim 10 &11

Etgen '759 teaches geologic model can be made from one frequency or a summation of frequencies (frequency-passband)(Etgen '759: Col7 Lines 18-35).

Regarding Claim 12

Etgen '759 teaches summation of frequency models as detailed in claim 11 above. Further, weighted summation is understood as convolution before summation, taught by Etgen '759, performed with frequency specific seismic data in frequency domain (through Fourier Transform) (Etgen '759: Col.5 Lines 41-51). Further,

frequency filtering is performed so weighted summation of frequency models is not needed as overlaps are reduced (Etgen '759: Figure 2 Element 100).

2. **Claims 13-25, 27-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,049,759 issued to John T. Etgen (Etgen '759 hereafter), in view of U.S. Patent No. 4,679,174 issued to Valery A. Gelfand (Gelfand '174 hereafter), further in view of U.S. Patent No. 5,838,634 issued to Thomas A. Jones et al (Jones '634 hereafter).**

<u>Regarding Claim 13</u>

Teachings & motivation to combine Etgen '759 & Gelfand '174 are disclosed in the claim 1 rejection above. Gelfand '174 teaches step (d) limitation of perturbing the rock data (Gelfand '174: Abstract).

Etgen '759 & Gelfand '174 do not teach the limitations of claim 13.

Jones '634 teaches the following as shown below.

Jones '643 teaches Step (a) as specifying training information corresponding to the desired components or criteria consistent with the model (Jones '643: Col.18 Lines 34-36).

Jones '643 teaches Step (b) as calculating statistics for the properties of initial model (Jones '643: Col.18 Lines 36-39).

Jones '643 teaches Step (c) as calculating objective function (Jones '643: Col.19 Lines 4-10).

Jones '643 teaches Step (d) as perturbing the rock properties (Jones '643: Col.19 Lines 30-33). Gelfand '174 also teaches perturbing as shown above.

Jones '643 teaches Step (e) as calculating the objective function for the new tentative model (Jones '643: Col.20 Lines 51-52).

Jones '643 teaches Step (f) as retaining perturbed rock property values and the new tentative objective function if the objective function is reduced (Jones '643: Col.20 Lines 60-67).

Jones '643 teaches Step (g) as repeating the steps (d) through (f) until the objective function is reduced to a specified limit (Jones '643: Col.21 Lines 13-21).

Jones '643 teaches Step (h) as outputting the geological model to a file (Jones '643: Col.21 Lines 22-23).

It would have been obvious to one (e.g. a designer) of ordinary skill in the art at the time the invention was made to take the teachings of Etgen '759 with Jones '643 to create frequency-passband geological model. The motivation would have been that frequency pass-band based geological models proposed by the Etgen '759 are not optimized based on the ability to perturb individual rock properties and Jones '643 provides that capability (Jones '643: Col.6 Lines 62-65) leading to better trained model based on iteration. Further motivation to combine comes from Etgen '759 as performing transformation speeds up the depth-amplitude-time seismic data processing (Etgen '759: Col.5 Lines 41-58; Jones '643: Col.9 Lines 15-21, Col.10 Lines 38-41).

It would have been obvious to one (e.g. a designer) of ordinary skill in the art at the time the invention was made to take the teachings of Gelfand '174 with Jones '643 to create 3-D geological model where rock properties are perturbed to enhance the model. The motivation would have been that Gelfand '174 performs the same process as Jones '643, but builds a 2-D geological model (Gelfand '174: Abstract)

where as Jones '643 teaches how to build a 3-D geological model with separate objective function to improve the accuracy of the model (Jones '643: Abstract).

Regarding Claim 14

Etgen '759 teaches storing the output of the frequency models (Etgen '759: Col.28 Lines 7-17).

Regarding Claim 15

Jones '643 teaches that training criteria are specified for each region depending on the realistic and accurate data (from borehole & well data), hence is unique to that region (Jones '643: Col.8 Lines 51-55; Col.9 Lines 59-63).

Regarding Claim 16 & 17

Etgen '759 teaches many frequency models (Etgen '759: Col.7 Lines 33-35). Etgen '759 does not teach perturbing for each model directly and is also mute over retaining the frequency content of the model.

Jones '643 teaches iterative perturbing to create a new tentative model for one model (Jones '643: Abstract).

Further, Jones '643 teaches that tentative models are perturbed through modification of the rock properties only. Hence rest of the 3-D model content is unaffected (Jones '643: Col.10 Lines 13-20).

It would have been obvious to one (e.g. a designer) of ordinary skill in the art at the time the invention was made to apply teachings of Jones '643 to Etgen '759 and perform iterative perturbing to one or more frequency models to get the best geological model. Further, modifying the rock properties would not affect the frequency content of the models as from Jones '643 teachings. The motivation

would have been to achieve the realistic and accurate result for the 3D model (Jones '643: Col.9 Lines 59-63).

Regarding Claim 18

Etgen '759 teaches step (b) as assigning a velocity model consisting of horizontally layered constant velocity media within area of interest (Etgen '759: Col.5 Lines 41-47; Col.17, Lines 38-41, 48-63) to the single frequency model (Etgen '759: Col.6 Lines 1-3, 22-26). Further, Etgen '759 teaches that other sources like well data can be combined to enhance the single frequency model (Etgen '759: col.16 Lines 61-67).

Further, Etgen '759 teaches step (c) as summing up all the individual frequency models to create a complete three-dimensional geological model (Etgen '759: Col.7 Lines 33-35).

Etgen '759 does not teach steps (a) & (d)-(l).

Gelfand '174 teaches step (a) that initial model is made based on the limits defined in the region and stratigraphics (Gelfand '174: Col.4 Lines 25-36). Etgen '759 teaches 3-D array (matrix) of contiguous model blocks representing the portions of subsurface earth volume (Etgen '759: Col.6 Lines 22-26; Figure 8A).

Gelfand '174 teaches step (d) as optimizing the initial model by the process of perturbing the rock properties (Gelfand '174: Abstract).

Jones '643 teaches Step (e) as specifying training information corresponding to the desired components or criteria consistent with the model (Jones '643: Col.18 Lines 34-36).

Jones '643 teaches Step (f) as calculating statistics for the properties of initial model (Jones '643: Col.18 Lines 36-39).

Jones '643 teaches Step (g) as calculating objective function (Jones '643: Col.19 Lines 4-10).

Jones '643 teaches Step (h) as perturbing the rock properties (Jones '643: Col.19 Lines 30-33). Gelfand '174 also teaches perturbing as shown above.

Jones '643 teaches Step (i) as calculating the objective function for the new tentative model (Jones '643: Col.20 Lines 51-52).

Jones '643 teaches Step (j) as retaining perturbed rock property values and the new tentative objective function if the objective function is reduced (Jones '643: Col.20 Lines 60-67).

Jones '643 teaches Step (k) as repeating the steps (h) through (j) until the objective function is reduced to a specified limit (Jones '643: Col.21 Lines 13-21).

Jones '643 teaches Step (l) as outputting the geological model to a file (Jones '643: Col.21 Lines 22-23).

It would have been obvious to one (e.g. a designer) of ordinary skill in the art at the time the invention was made to take the teachings of Gelfand '174 and apply them to Etgen '759 to create a 3D geological model from various frequencies and perturb the rock data to achieve the desired degree of correspondence with real data. Although Gelfand '174 is teaching a 2-D Model geological model, the motivation to combine would be that Gelfand '174 teaches the process of geological modeling using the process of perturbing, which can change the underlying geological model to achieve the desired result in iterative steps (Gelfand '174:

Abstract). Etgen '759 teaches performing 3-D seismic analysis and model but processes the information much more efficiently (converting the data to frequency domain using Fourier transform) as the data collected is much more (Etgen '759: Col.1 Lines 40-45). Combing the two reference will yield more truer picture 3-D geological model (Etgen '759: Col.3 Lines 14-20) and perturbation will make the model more precise, a more actual representation of the subsurface conditions (Gelfand '174: Abstract; Col.4 Lines 15-20).

It would have been obvious to one (e.g. a designer) of ordinary skill in the art at the time the invention was made to take the teachings of Jones '643 and apply them to Etgen '759 to create frequency-passband geological model. The motivation would have been that frequency pass-band based geological models proposed by the Etgen '759 are not optimized based on the ability to perturb individual rock properties and Jones '643 provides that capability (Jones '643: Col.6 Lines 62-65) leading to better trained model based on iteration. Further motivation to combine comes from Etgen '759 as performing transformation speeds up the depth-amplitude-time seismic data processing (Etgen '759: Col.5 Lines 41-58; Jones '643: Col.10 Lines 38-41).

It would have been obvious to one (e.g. a designer) of ordinary skill in the art at the time the invention was made to take the teachings of Gelfand '174 with Jones '643 to create 3-D geological model where rock properties are perturbed to enhance the model. The motivation would have been that Gelfand '174 performs the same process as Jones '643, but builds a 2-D geological model (Gelfand '174: Abstract)

where as Jones '643 teaches how to build a 3-D geological model with separate objective function to accuracy of the model (Jones '643: Abstract).

<u>Regarding Claim 19</u>

Etgen '759 teaches that rock properties are measurable properties consisting of P velocity, S velocity, attenuation/dissipation (Q), density, <u>porosity</u>, and permeability (Etgen '759: Col.17 Lines 58-63)(Gelfand '174: Col.2 Lines 1-3).

<u>Regarding Claim 20</u>

Gelfand '174 teaches that rock properties assigned to the model can be verified with the real well data (Gelfand '174: Col.2 Lines 4-12). Porosity is the limitation disclosed by Etgen and also Gelfand.

<u>Regarding Claim 21 & 22</u>

Etgen '759 teaches geologic model can be made from one frequency or a summation of frequencies (frequency-passband)(Etgen '759: Col7 Lines 18-35).

<u>Regarding Claim 23</u>

Etgen '759 teaches summation of frequency models as detailed in claim 11 above. Further, weighted summation is understood as convolution before summation, taught by Etgen '759, performed with frequency specific seismic data in frequency domain (through Fourier Transform) (Etgen '759: Col.5 Lines 41-51). Further, frequency filtering is performed so weighted summation of frequency models is not needed as overlaps are reduced (Etgen '759: Figure 2 Element 100).

<u>Regarding Claim 24</u>

Jones '634 teaches perturbing the rock-property values comprises a series of sequential steps, wherein each step attempts to force a nearly perfect fit of the model statistics to one of the training criteria (Jones '634: Abstract Lines 12-18).

Regarding Claim 25

Jones '634 teaches replacing rock property values in a block with values from the corresponding value from the intersecting well-borehole data (Jones '634: Col.13 Lines 61-67).

Regarding Claim 27

Gelfand '174 teaches that every parameter of the rock property is perturbed (Gelfand '174: Col.9, Lines 25-27).

Regarding Claim 28

Jones '643 teaches that training criteria are specified for each region depending on the realistic and accurate data (from borehole & well data), hence is unique to that region (Jones '643: Col.8 Lines 51-55; Col.9 Lines 59-63).

Regarding Claim 29

Jones '643 teaches that steps performed above are conducted on the digital computer (Jones '643: Col. 11 Lines 66-67, Col.12 Lines 1-2).

3. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,049,759 issued to John T. Etgen (Etgen '759 hereafter), in view of U.S. Patent No. 4,679,174 issued to Valery A. Gelfand (Gelfand '174 hereafter), further in view of U.S. Patent No. 5,838,634 issued to Thomas A. Jones et al (Jones '634 hereafter), further in view of applicant's own admission.

Regarding Claim 26

Teachings of Etgen '759, Gelfand '174 & Jones '634 are disclosed above.

Etgen '759, Gelfand '174 & Jones '634 do not teach the limitations disclosed in claim 26.

Applicant's attention is draw to specification page 22 section (b) stating

> "Tentative porosity values assigned to all blocks in the geologic model are simultaneously perturbed to new values using the rank-transform method. This method, known to persons skilled in the art of geologic modeling, resets the tentative cumulative frequency distribution of porosity calculated from the tentative geologic model to the desired cumulative frequency distribution of porosity. This step simultaneously perturbs rock property values in all blocks of the complete geologic model."

It would have been obvious to one (e.g. a designer) of ordinary skill in the art at the time the invention was made to use techniques known in the art to reset the tentative cumulative frequency distribution of porosity calculated from the tentative geologic model to the desired cumulative frequency distribution of porosity for the purpose of improving the accuracy of the model.

(10) Response to Argument

Appellants argue various reasons why they believe the cited references alone or in combination fail to render the claimed subject matter obvious. Each argument is addressed below.

Grounds of Rejection No. 1:

First Point (Argument):

Appellant argues that a velocity model is not equivalent to a frequency passband model and that the examiner has not established a case of prima facia case of obviousness. Further stating MPEP 2183 for a rational to establish equivalence (3 steps).

Examiner's Response to First Point (Argument):

In response to MPEP 2183 *step (A): performs the function specified in the claim.* As shown by (*Specific Mapping Added to address Applicant's remarks in Appeal Brief*) in claim 1 above, an exact mapping is shown having multiple frequency slices (bandwidths). The velocity Model was equated in the past office actions as equivalent to the frequency passband model to give an overall picture since all that is done is a transform (as shown in Fig.3A-B). However the claim does not address where the "initial frequency passband models are generated from"; therefore whether it is the velocity model or the frequency model, both are disclosed by Etgen and since appellants claims do not preclude the initial use of a velocity model to create the frequency model, no patentable difference is seen between Etgen and the claimed invention.

Examiner had previously stated in the final office action:

> Examiner agrees with the applicant that the velocity model is not a frequency passband model. However, the velocity and frequency are mathematically related and proportional quantities over a given distance. Hence the distinction among model formed by velocity or frequency is not

> patentably different. The only difference the examiner sees in the claimed language is the sequence of steps. Etgen reference assigns the rock properties to the velocity model before forming various frequency passband slices and the applicant assigns rock properties after frequency passband model is formed, both leading to the functionally same results of detailed accurate "rock parameter" assignment (hence functionally equivalent) (Etgen: Col.3 Line 57-Col.4 Line 17). Etgen does not exclude the frequency passband model as he himself creates frequency slices (Etgen: Fig.1). Further, Etgen teaches using well logs and other non-seismic data to get rock properties and apply them to stacked (velocity model) or un-stacked (frequency passband models) data (Etgen: Col.16 Line 58-Col.17 Line 8).

Appellants' affidavit under rule 1.132 was filed after the final rejection is thus not considered timely (MPEP 716.01). However, in the interest of fully addressing all of the appellant's arguments, it is considered that the affidavit states no more than what is in the appellant's brief. The brief, which is proper, is fully addressed in this answer. Therefore, the affidavit is also considered to be fully addressed.

Further, appellants argue (Appeal Brief: Pg.8 ¶2) that composite volume represents processed seismic data, and not a three dimensional geologic model.

Examiner respectfully disagrees, as this composite volume represents three-dimensional depth migrated data is a geologic model that can be used to prospect for hydrocarbons. Examiner further notes that appellants further agree that Gelfand teaches a *two dimensional lithographic (Geologic) model* (Appeal Brief: Pg.10 ¶2).

Etgen '759 Col.2 Lines 3-26

> The data in a 3-D survey are amenable to viewing in a number of different ways. First, horizontal "constant time slices" may be taken extracted from a stacked or unstacked seismic volume by collecting all digital samples that occur at the same travel time. This operation results in a 2-D plane of seismic data. By animating a series of 2-D planes it is possible for the interpreter to pan through the volume, giving the impression that successive layers are being stripped away so that the information that lies underneath may be observed. Similarly, a vertical plane of seismic data may be taken at an arbitrary azimuth through the volume by collecting and displaying the seismic traces that lie along a particular line. This operation, in effect, extracts an individual 2-D seismic line from within the 3-D data volume.
>
> Seismic data that have been properly acquired and processed can provide a wealth of information to the explorationist, one of the individuals within an oil company whose job it is to locate potential drilling sites. For example, a seismic profile gives the explorationist a broad view of the subsurface structure of the rock layers and often reveals important features associated with

> the entrapment and storage of hydrocarbons such as faults, folds, anticlines, unconformities, and sub-surface salt domes and reefs, among many others.

Etgen '759 Col.16 Lines 58- Col.17 Line 9:

> The explorationist may do an initial interpretation 120 of the resulting stacked volume, wherein he or she locates and identifies the principal reflectors and faults wherever they occur in the data set. Finally, as noted in FIG. 2, the explorationist will use the processed seismic data to locate subsurface structural or stratigraphic features conducive to the generation, accumulation, or migration of hydrocarbons (i.e., prospect generation 160). This effort may incorporate additional data from a variety of non-seismic sources including, for example, well logs, satellite surveys, gravity surveys, etc. Additionally, the explorationist may use the migrated data volume (either stacked or unstacked) as a source for the generation of seismic attributes 140 that may be displayed 60 and studied in their own right. Seismic attributes 140 can reveal subsurface details that are at odds with the initial seismic data interpretation 120, thus suggesting the need for a reinterpretation 150 of the seismic volume before moving to the prospect generation 160 stage.

In response to MPEP 2183 *step (B): is not excluded by an explicit definition provided in the specification for an equivalent.* No arguments were presented by appellant for this rational, however examiner cited in final office action that Etgen does not exclude the frequency passband model as he himself creates frequency slices (Etgen '759: Fig.1).

In response to MPEP 2183 *step (C): is an equivalent of means- (or step-) plus-function limitation.* The present claims do not include means plus function limitation.

Examiner respectfully disagrees with the appellant that claims are not equivalent, by clearly mapping the limitations. Furthermore, it is not the mere equivalence that is relied upon by the actual similarity between the frequency models and appellant's claims do not preclude this interpretation.

Second Point (Argument):

(a) Appellants have argued that equivalence between the velocity model and frequency passband model is improper and unsupported (also Appeal Brief: Pg.10 ¶1).

(b) Further, Etgen fails to disclose the sequence of steps, e.g. "assigning value for at least one rock property in each initial frequency passband model" as recited in claim 1.

Appellants argue that Gelfand (Appeal Brief: Pg.10 ¶2) does not disclose or suggest generating a frequency passband model much less assigning rock property in a frequency passband model.

(c) Appellants argue that the combination Etgen & Gelfand (Appeal Brief: Pg.10 ¶3, Pg.11 ¶1) does not disclose of suggest "optimizing the initial complete *three dimensional geologic model* by perturbing the rock property values in at least one of the models according to specified geological criteria."

<u>Examiner's Response to Second Point (Argument):</u>

(a) The response to equivalence between the velocity model and frequency passband model is presented above. Arguments presented in reference to Etgen (Appeal Brief: Pg.10 ¶1) are considered but found to be unpersuasive for the reasons above.

(b) Appellants further argue that Etgen does not disclose the sequence of steps especially "assigning value for at least one rock property in each initial frequency passband model". Examiner had stated in final office action (Pgs.4-5):

> The only difference the examiner sees in the claimed language is the sequence of steps. Etgen reference assigns the rock properties to the velocity model before forming various frequency passband slices and the applicant assigns rock properties after frequency passband model is formed, both leading to the functionally same results of detailed accurate "rock parameter" assignment (<u>hence functionally equivalent</u>) (Etgen: Col.3 Line 57-Col.4 Line 17).
>
> Applicant has not provided any support as to how the assignment of the rock properties after frequency slicing (leading to frequency passband model) is yields result any different from assignment of rock properties to the velocity model before pre-slicing into frequency bands. Disclosure provided also does not differentiate frequency passband over prior art and is limited in scope as to how the frequency passband model is different from the velocity model (Specification: [0028]-[0030]).

Appellants have not presented any argument that would make this sequence of steps yield a different result. Restating the same position again, examiner asserts that the sequence of steps is irrelevant as long as the same result is achieved which is done.

Appellants argue that Gelfand (Appeal Brief: Pg.10 ¶2) does not disclose or suggest generating a frequency passband model much less assigning rock property in frequency passband model. Examiner asserts that Etgen reference is used to meet these limitations and appellants are performing piecemeal analysis of the combination. Etgen teaches a velocity model having rock properties and Gelfand teaching perturbing the rock properties (See Claim 1 rejection above). Both Gelfand (Gelfand: Col.5 Lines 62 Col.6 Line 5) and Etgen teach velocity model.

(c) Appellants argue that the combination Etgen & Gelfand (Appeal Brief: Pg.10 ¶3, Pg.11 ¶1) does not disclose of suggest "optimizing the initial complete *three dimensional geologic model* by perturbing the rock property values in at least one of the models according to specified geological criteria." Examiner asserts that Gelfand clearly teaches, "perturbing the rock property values in at least one of the models according to specified geological criteria" (Gelfand: Abstract). Examiner disagrees that Etgen & Gelfand do not teach performing optimization on a *three-dimensional geologic model* as although the embodiments are limited to *two-dimensional geologic model, the* same process is applied to the *three-dimensional geologic model* (Etgen: Col.2 Lines 3-15; Gelfand: Col.1 Lines 60-64).

Etgen: Col.2 Lines 3-15:

> <u>"The data in a 3-D survey are amenable to viewing in a number of different ways</u>. First, horizontal "constant time slices" may be taken extracted from a stacked or unstacked seismic volume by collecting all digital samples that occur at the same travel time. This operation results in a 2-D plane of seismic data. <u>By animating a series of 2-D planes it is possible for the interpreter to pan through the volume, giving the impression that successive layers are being stripped away so that the information that lies underneath may be observed</u>. Similarly, a vertical plane of seismic data may be taken at an arbitrary azimuth through the volume by collecting and displaying the seismic traces that lie along a particular line. This operation, in effect, extracts an individual 2-D seismic line from within the 3-D data volume."

Gelfand: Col.1 Lines 60-64

> "The display of seismic data may be a two-dimensional structural profile of subsurface rock layers as above described or it may take the form of a three-dimensional display of the physiographic features of one or more selected rock layers."

Third Point (Argument):

(a) Appellants argue that examiner's construction appears to change the principle of operation of Etgen and renders it unsatisfactory for its intended purpose as Etgen undergoes computationally intensive processes to form the single composite volume.

Examiner's Response to Third Point (Argument):

(a) First the extent of computation performed by the Etgen is not relevant to the patentability of the current set of claims. Further, as shown above in the rejection, frequency passbands are clearly mapped and this does not change the principle of operation of Etgen, therefore appellant's arguments are unpersuasive.

Fourth Point (Argument):

(a) Appellants argue that the examiner has relied on the hindsight reconstruction to reject the claimed subject matter. For example, the equivalence between the Etgen's velocity model and the instant frequency passband model.

Examiner's Response to Fourth Point (Argument):

(a) Appellant's argument with respect to hindsight is not understood. The feature being argued against is the velocity model being an equivalent to a frequency model. As pointed out in the rejection above, the frequency model is created from the velocity model by the use of a transformation. Furthermore, it is not the velocity model that maps to the frequency model of the appellants but the frequency model of the Etgen that maps to the appellant's frequency model. The point at which the rock properties are

entered is not precluded by appellant's claim language. Hence no impermissible hindsight has been used to reject the claims.

Combination of Gelfand with Etgen would create a 3D geological model from various frequencies and perturb the rock data to achieve the desired degree of correspondence with real data. The motivation to combine would be that Gelfand '174 teaches the process of geological modeling using the process of perturbing, which can change the underlying geological model to achieve the desired result in iterative steps (Gelfand '174: Abstract). Etgen '759 teaches performing 3-D seismic analysis and model but processes the information much more efficiently (converting the data to frequency domain using Fourier transform) as the data collected is much more (Etgen '759: Col.1 Lines 40-45). Combing the two reference will yield more <u>accurate</u> picture 3-D geological model (Etgen '759: Col.3 Lines 14-20) and perturbation will make the model more precise , a more actual representation of the subsurface conditions (Gelfand '174: Abstract; Col.4 Lines 15-20).

Examiner therefore respectfully disagrees with the appellant that references fail to disclose all of the claimed elements and establish a prima facia case of obviousness. Further there is no modification of Etgen reference as claimed by appellant, as clear mapping provided above.

<u>Grounds of Rejection No. 2:</u>

Appellants have presented four similar points as in the "Grounds of Rejection No.1". The examiner maintains the same response as presented for "Grounds of Rejection No.1". In the interest of brevity, the responses as set forth above are equally applicable to the "Grounds of Rejection No.2". Further, appellants have performed piecemeal

analysis with Jones (third reference) as not teaching limitation (Appeal Brief: Pg.16¶1st) already taught by Etgen.

Examiner therefore respectfully disagrees with the appellants that the references fail to disclose all of the claimed elements and establish a prima facia case of obviousness.

Grounds of Rejection No. 3:

It is submitted that the rejection of the claim 26 should be upheld since the rejection of claim 18, as set forth above, is proper. Appellant's argument for claim 26 rests upon the argument for claim 18 which is treated above.

(11) Conclusion:

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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Wednesday, September 20, 2006

Conferees:

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